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Specification the invention relates to the use of organic compounds as liquids for frictional force transmission, in particular in friction gears.

Friction wheel or traction transmissions is apparatuses, transmitted in which a torque becomes by nominal point or alignment. In simplified form such a friction gear consists itself of two rollers with parallel or cutting axes, which stand with one another in tangential contact, whereby a roller the drive member, and which represents others the driven member. The transferable torque of a such rubbing or traction transmission is a direct function of the surface pressure between the rollers and coefficient of friction of the frictional contact between the roll surfaces.

Particular advantages of traction transmissions are beside a oscillation-poor course the possibility of the stepless variable of the gear ratio bottom full load, without the load must become interrupted during the other one the translation, as well as their high efficiency in the entire translation range.

A disadvantage of the friction gears exists still in the substantial larger dimensions opposite gear transmissions with same transferable performance and same life. Since the transferable performance of the peripheral velocity of the friction discs at the radius of the frictional contact, on which in the frictional contact transferable normal force depends and on the coefficient of friction of the frictional contact usable to the power transmission more linear, all three measured variables as high must become as possible for the construction of a friction gear selected. Those transferable normal force is given by allowable Hertz pressing. This the certain life of the transmission. The peripheral velocity becomes concentrated by the size. The coefficient of friction usable in the transmission becomes essentially by the slippage, certain by the peripheral velocity of the drive body and the contact pressure between the drive and drift bodies.

The coefficient of friction is defined as quotient from the frictional force and the contact pressure between the drive and drift bodies, resultant with the friction. The slippage is defined as the absolute value of the quotient from the difference of the two peripheral velocities of the rolling members and the larger peripheral velocity.

With traction transmissions desired becomes that in the range of a small slippage the coefficient of friction with increased slippage rapid rises. Thereby achieved one a good efficiency of the traction transmission.

In addition desired that the maximum coefficient of friction is if possible large, will reach in order a maximum utilization of the power transmission (see. z. B. D.E.G.

Tucker, ant. Propulsion technology 17, No. 6, June 1978).

The coefficient of friction becomes certain by the chemical structure of the traction liquid and the operating parameters of the friction gear. In addition roll and running speed, normal force in the frictional contact, macro and micro geometry of the role surface and thus geometric shape of the frictional contact, temperature in the frictional contact, drilling friction and tape skew count.

To the increase of the torque which can be transferred the type and composition of the liquid are most easily more variable by these factors. It was not missing therefore at experiments for the location from compounds to the improvement of the traction coefficient. The DE-AS 1,644,925 and DE-AS 1,644,926 describes for this purpose a variety of organic compounds.

As particularly suitable compounds with high coefficient of friction  $z$  become. B. Decalin, 1,2-Hydrindan, Perhydrophenanthren, Perhydrofluoren, Perhydrofluoranthren, Perhydroazonaphthen, Cyclohexyldecalin, primary Perhydrocyclopentadien and Methylenhydrophenanthren mentioned.

In addition, with an high coefficient of friction of the traction liquid an high wear of the traction transmission is linked. In order to keep the wear as small as possible also with high coefficient of friction, it is required that also the so called load-carrying capacity of the liquid film is if possible high. By the fact achieved becomes that also in the case of fail-safe a certain lubricating action is present.

Object of the invention is it therefore to make traction liquids available which possess an high coefficient of friction in compound with an high load-carrying capacity.

This object becomes dissolved with the instant invention.

Subject-matter of the invention is the use of compounds with or several by or two alkylene chains, which exhibit in or two carbon atoms, a verb-moved cyclohexane and/or Cycloheptanring, that by or several substituents from that Group alkyl, alkylidene, Alkoxy, Alkanoyl, Alkylcarbonyloxy, Alkoxycarbonyl, Oxoalkyl, Merkpto, Alkylmerkpto, Alkanoylmerkpto, halogen and hydroxyl substituted is and where the alkyl and Alkylidenreste 1 to 7 carbon atoms to possess and where also Cycloalkyl alkyl in the O-haltigen substituents can mean, and two at same or various ring carbon atoms bonded alkyl groups together also an alkylene group to form to be able, and the ring system, which alkyl, Cycloalkyl and/or alkylene groups also or several double bonds to contain to be able, and where the alkyl and/or alkylene groups of the substituents mentioned by or several remainders from the group an alkyl, Cycloalkyl, Hydroxy, halogen, Alkoxy, Cycloalkoxy, Alkanoyl, Alkylcarbonyloxy, Alkoxycarbonyl, Merkpto, Cycloalkoxycarbonyl and Cyano, in which an alkyl or a cycloalkyl group possesses 1 to 7 carbon atoms and together also Cycloalkyl alkyl represent and or several double bonds can contain, substituted to be to be able, and where two or several verb-moved cyclohexane and/or Cycloheptanringe can be mentioned linked with one another over the substituents, as traction liquid in friction transmissions.

Cyclohexane or Cycloheptanringsystem verb-moved by two or preferably an alkyl group with 1 or 2 carbon atoms is preferably a cyclohexane ring verbrückter by methylenes or ethylen, like  $z$ . B. Bicyclo2.2.2toctan, and in particular Bicyclo3.2.1ioctan, Bicyclo3.1.1heptan, Bicyclo2.2.1heptan or Tricyclo [- # .2.1.02'67 decan.

The ring system can also contain or several, preferably a double bond, and is then  $z$ . B.

Bicyclo2.2.1hept-5-en.

An alkyl group with 1 to 7 carbon atoms can be straight or branched and is  $z$ . B. Methyl, ethyl, Propyl, Isopropyl, Butyl, Isobutyl, third. - Butyl, Pentyl, Isopentyl, Neopentyl, Hexyl, Isohexyl, Heptyl, Isoheptyl, 2,3,3-Trimethyl-butyl, etc. Preferred ones are alkyl groups with 1 to 4 in particular, and with 1 or 2 carbon atoms.

A Alkylidengruppe is derived from one of the alkyl groups mentioned with 1 to 7 carbon atoms, in particular of the preferred alkyl groups mentioned by one, and been  $z$ . B. Methyliden or ethyliden.

An alkylene group formed from two alkyl substituents preferably possesses 2 to 5 carbon atoms and is  $z$ . B. one # thylen, propylene, Butylen or Pentylengruppe. With such an alkylene group substituted verb back width units ring system is  $z$ . B.

Cyclopropan < l-spiro-2 > - norbornan or Decahydro-1,4methano-azulen.

A cycloalkyl group is such with 3 to 7, preferably 5 to 7 carbon atoms and is  $z$ . B.

Cyclopropyl, Cyclobutyl, Cyclopentyl, Cycloheptyl, and in particular cyclohexyl. An Cycloalkyl alkyl

group is such, which consists of the Cycloalkylund mentioned alkyl radicals, in particular from that preferred mentioned.

An alkyl or a cycloalkyl group can do also or several, z. B. two, and in particular a double bond contain. A cycloalkyl group with more than two, D. h. thus three double bonds, is Cycloheptatrien (1,3,5) - yl and in particular Phenyl.

A Alkoxy, a Alkanoyl, Alkylcarbonyloxy and an alkoxy carbonyl group are derived from the mentioned, in particular that preferred alkyl and cycloalkyl residues mentioned. They are z. B., Methoxy, Ethoxy, Cyclohexyloxy, acetyl, propionyl, Hexylcarbonyl, Acetoxy, Propionyloxy, Hexylcarbonyloxy, Äthoxycarbonyl, Hexyloxycarbonyl, 1 - or 2-Cyclohexylpropyl (2) - oxy etc.

A Oxoalkylgruppe is several, in particular or two oxo group a substituted alkyl group, by or, which is derived from one of the alkyl radicals or also cycloalkyl residues mentioned. It is z. B.

2-Oxo-äthyl, 2 - or 3-Oxo-propyl, mono or Dioxo butyl, Pentyl or Hexyl, like z. B. 1,4-Dioxopentyl, 2,5-Dioxo-hexyl, Oxocyclohexyl, and in particular Formyl.

Halogen as substituent preferably means fluorines and in particular chlorines.

The compounds according to invention contain or several same or various, preferably two and in particular a verb-moved cyclohexane and/or Cycloheptanring. These rings an interconnecting remainder is such, which is derived from the substituents mentioned, which are in this case thus common substituents of the too interconnecting ring systems. Such Sub stituenten is z. B. of the alkyl or Cycloalkylsubstituenten derived alkyl or Cycloalkylengruppen, like z. B. Cyclohexylen (1,4), or also a alkyl cycloalkylen group, of the Alkoxy or alkoxy carbonyl groups derived Alkylenoxy or Alkylenoxycarbonylgruppen - alkyl NO or - alkyls degrees (O) -, of the alkanoyl groups derived alkyls carbonyloxygruppen alkyl C (O) -O, a Oxycarbonylgruppe O C (O) -, Carbonyloxyalkylenoxycarbonylgruppen C (O) -O - alkyl O C (O) -, Alkylenoxycarbonylalkylengruppen alkyls degrees (O) - alkyl etc.

The verb-moved ring systems and/or the alkyl and alkylene groups of the substituents of the verb-moved ring systems can be by or several, preferably 1 to 5, and in particular in or two of the remainders substituted specified for it, which can be same or various. Typical substituents or composed substituents of the ring systems are z. B.

Hydroxy, Hydroxymethyl, Hydroxyäthyl, 1-Methyl-hydroxy ethyl, Acetoxy, Acetoxymethyl, Cyclohexylcarbonyl, Cyclohexyloxycarbonyl, Cyclohexylcarbonyloxy, Cyclohexylcarbonyloxymethyl, Cyclohexyloxycarbonylmethyl, 2-Äthoxy carbonyl-2-cyano-äthyl, 1-Methyl-1-cyclohexyl-äthoxycarbonyl, 1-Methyl-1 (4-methyl-cyclohexen-3-yl) - äthoxycarbonyl, 1, 1-Dichlor-ethylen (preferably to the same carbon atom of the verb-moved ring system bottom formation one Spiro cyclopropanrings bonded) or 1-Methyl-1-carbonyloxy-4 (1-methyl-1-carbonylOxy ethyl) - cyclohexane (as common substituent of two, bonded over the two carbonyl groups, verb-moved ring systems).

Like mentioned above, also Tricyclo/5.2.1.02, 6 become] decane preferred, by 1 to 5, preferably 1 to 3 substituent from the group alkyl, Hydroxy, Mercapto, Alkoxy, Alkylmercapto, Alkanoyloxy and Alkanoylmercapto the substituted are and where an alkyl group (and/or. Alkanoyl group) 1 to 7 carbon atoms possesses and if necessary by or several, in particular in or two hydroxy groups, Mercaptogruppen and/or halogen, in particular bromine or chlorine, substituted to be can.

The Tricyclo [5.2.1.02,6] decan (TDC) exhibits the subsequent structure:

EMI8.1

To the use of Peibradgetrieben good suitable representative compounds according to invention are z. B.

the 2-Hydroxymethyl-6,6-dimethyl-bicyclo [3.1.1] heptane, 2-Hydroxymethyl-3,3-dimethyl-bicyclo [2.2.1] heptane, 3-Acetoxy-2,6,6-trimethyl-bicyclo [3.1.1] 2-Acetoxymethyl-6,6-dimethyl-bicyclo [3.1.1] heptane, 2 - (2-Hydroxyäthyl) -3,3-dimethyl-bicyclo [2.2.1] heptane, 2-Methyliden-3-acetoxy-6,6-dimethyl-bicyclo [3.1.1] hept on, 4,8,8-Trimethyl-9-acetoxymethyl-decahydro-1,4 methano azulen, 4,8,8-Trimethyl-9-hydroxymethyl-decahydro-1, - 4-methano azulen, 2-Cyano-3

(3,3-dimethyl-bicyclo [2.2.1] - hept-2-yl-propionsäureäthylester, 2,2-Dichlor-cyclopropan < 1-spiro-2 > -6,6-dimethyl-bicyclo [3.1.1] heptane, (3,3-Dimethyl bicyclor2.2.17hept-2-yl) - carbonic acid cyclohexyl ester, 3-Cyclohexylcarbonyloxymethyl-6,6-dimethyl-bicyclo [3.1] heptane, 3-Cyclohexylcarbonyloxy-2,6,6-trimethyl bicyclo[3.1.1]heptan, 3 (3,3-Dimethyl-bicyclo [2.2.1] hept-2-yl) - carbonyloxy-2,6,6-trimethyl-bicyclo [3.1.1] heptane, 3 (3,3-Dimethyl-bicyclo[2.2.17-hept-2-yl) - carbonylOxy methyl-2,2-dimethyl-bicyclo[2.2.11-heptan, found on (and/or Isobornan) - yl-cyclohexancarbonsäureester, 2 - (1-Nethyl 1 cyclohexyl äthoxycarbonyl) 3,3-dimethyl-bicyclo [2.2.1] - heptane, 4,8,8-Trimethyl-9 (3,3-dimethyl-bicyclo# hept-2-yl-carbonyloxymethyl-decahydro-1,4-methano-azulen, Isoborneol, 2 [1 - (4-Methyl-cyclohex-3-enyl) -1-methyl äthoxycarbonyl] - 3,3-dimethyl-bicyclo [2.2.1] heptane, 1-Methyl-1-F (3,3-dimethyl-bicyclo[2.2.17hept-2-yl) - carbonyloxy-7-4 [1 (3,3-dimethyl-bicyclo [2.2.1] hept-2-yl)-- 1-methyl-äthyl-7-cyclohexan; in particular the 3-Hydroxy 2,6, 6-trimethyl-bicyclo[3.1.1]heptan, 2,2-Dimethyl-3 cyclohexyloxycarbonylmethyl-bicyclo[2.2.1]heptan, 2,2-Dimethyl-3 (2-cyano-2-äthoxycarbonyl-äthyl) - bicyclo .2. # heptan, 2,2-Dichlor-cyclopropan 1-spiro-2 -3,3-dimethyl-norbornan, 4,8,8-Trimethyl-9-formyldecahydro-1,4-methano-azulen; and primarily the 1,5-Dimethyl-6-cyclohexanoyloxy-bicyclo [3.2.1] octan, 2, 2-Dimethyl-3-cyclohexanoyloxy-methyl-bicyclo .2. 1# - heptan, the 4,8,8-Trimethyl-9-cyclohexanoyloxymethyl-decahydro-1,4-methano-azulen 4,8, 8-Trimethyl 9 (2-cyano-2-äthoxycarbonyl-äthyl) - decahydro-1,4-methano azulen, 8 (9) - hydraulic XY, 8 (9), 3,4-Trihydroxy, the 3 (4) - Hydroxymethylen, the 3 (4) or 8 (9) - Diacetyloxyund the 3 (4,5) - the-isobuttersäureester-tricyclo [5. 3 (4,5) - the-isobuttersäureester-tricyclo [5.2.1.02,6] - decan.

Used the according to invention compounds are known or can after actual known methods in analogy to the known compounds or from the known compounds, z. B. by esterification, saponification, Verätherung, halogenation etc. prepared become.

The compounds according to invention are suitable excellent as power transmission fluids for traction transmissions, like z. B. in looping gears or Wälzgetriebe user. They are characterised by a particularly favourable combination of traction characteristics (high coefficients of friction within the range of approximately 0.05 to approximately 0.11, strong increase of the coefficient of friction in the range of a slippage to 1%) and Notlaufeigenschaften (high load-carrying capacity of the liquid film).

The compounds according to invention can alone or in the mixture with other compounds according to invention, in addition, in the mixture with other known traction liquids used become. As other traction liquids or partial hydrogenated Cyclopentylbiphenylene is suitable for example completely and - naphtha LINE with one to two Cyclopentylgruppen. Besides they can contain of also still conventional additives in for it the conventional amounts, like z. B.

Antioxidantien, rust inhibitors, dense swelling means, antifoaming agent, dispersing agent, dyes, viscosity index improver, extreme Pressure of additive, anti wear additives and/or also lubricants.

If the compounds according to invention in mixture with other traction liquids become used, then these mixtures contain the compounds according to invention generally in an amount of at least 5 Gew. - %, in particular of at least 30 Gew. - %. That content depends thereby in particular on the type and the properties of the other traction liquids.

The subsequent examples describe the invention, without limiting it to it.

Example 1 in a two-disk friction test stand after K. Plunger (construction 31, 1979, 2 to 6) becomes the dependence of the coefficient of friction ss by the slippage s certain.

The discs consist of a material, which becomes 6 described according to DIN 17006 with 100 CR. The discs have a diameter of 80 mm. The arithmetical center rough value RA (center LINE AVERAGE CLA) of on and driven pulley lies within the range of 0,03 to 0.12 to.

The liquid which can be examined becomes injected at an injecting temperature of 50 °C between the two discs.

Example 2 in the two-disk friction test stand described in example 1 the subsequent compounds examined became, for in the Fig. 1 to 27 of the drawing the dependence of the coefficients of

friction of the slippage with various contact pressures FN (within the range of 125 to 4080 N) and peripheral velocities  $v_l$  (within the range of 0,42 to 12.57 m/s) shown becomes.

As traction liquid used became: 4,8, 8-Trimethyl-9-formyl-decahydro-1, 4-methano-azulen (boiling point 116 to 120 °C with 0,7 mbar) (of Fig. 1 to 5), 2,2-Dichlor-cyclopropan < 1-spiro-2 > -3, 3-dimethyl norbornan (boiling point 120 °C with 18 mbar) (of Fig. 6 to 10), 3-Hydroxy-2,6,6-trimethyl-bicyclo [3.1.1] heptane (boiling point 94 °C with 13 mbar) (of Fig. 11 to 14), 4,8, 8-Trimethyl-9-cyclohexanoyloxymethyl-decahydro 1,4-methano-azulen (Fig. 15 to 18), 1,5-Dimethyl-6-cyclohexanoyloxy-bicyclo[3.2.1] octan (Fig. 19 to 23) and 2,2-Dimethyl-3-cyclohexyloxy-carbonylmethyl-bicyclo [2.2.1] heptan (Fig. 24 to 27).

2 various 26 TricycloLi.2.1.0 ~j-decane examined describe, became example 3 as in example.

The results are in the figs 28 to 37 of the accompanying drawing shown.

As traction liquids used became: 8 (9) - Hydroxyderivat (TDC alcohol A; Fig. 28, 29), 8 (9), 3,4-Trihydroxyderivat (TDC alcohol B; Fig. 30, 31) the 3 (4) - Hydroxymethylderivat (TDC alcohol C; Fig. 32, 33), the the acetyl ester derivative; (Fig. 34, 35) and the the isobutyric acid ester derivative (Fig. 36, 37).